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THE HABITS OF THE STRIPED MEADOW  
CRICKET (*ÆCANTHUS FASCIATUS* FITCH).

JOSEPH L. HANCOCK.

IN uncultivated wastes the common horse-weed (*Leptilon canadense* L.) often takes possession of the soil and flourishes most luxuriantly. Owing to its rapid growth, it not infrequently overshadows the neighboring clover, wormwood, knotweed, daisy fleabane, and other forms of plants which may happen to live where its society conflicts. There are many interesting features in the miniature forests of weeds, not the least of which is the insect life they harbor. In the last of August the weed first mentioned commonly attains a maximum height in sandy soil of from four to six feet, and it is at this period that it seemingly furnishes an ideal environment for the striped cricket *Æcanthus fasciatus* Fitch.<sup>1</sup>

My experience with this cricket (see Fig. 2), which is here related, is principally drawn from observations made at Lakeside, Michigan, during the month of August, the last day of September, and the first two days in October, 1904. Further studies

<sup>1</sup> This cricket is commonly classed among the tree crickets, but it never or rarely lives on trees.

of its habits were carried out on numerous live individuals which I transported to my home in Chicago.

I have found this insect living singly, or from one to four together, upon the horse-weed, the females predominating during August. It is found more often on the main central stem, from eighteen inches to two and a half feet from the top, attracted there doubtless for the purpose of courtship and oviposition. Here it exhibits exquisite protective resemblance. The body of the insect is colored pale green, but the legs, antennæ, maxillary palpi, head, thorax, cerci, ovipositor, the ventral aspect of the thorax and abdomen, are very dark, though the color is somewhat variable. It is a delicate soft bodied insect, with exceptionally long antennæ. One of its favorite habits is closely to grasp the green main stem of its chosen plant with its body resting upside down. When disturbed, its first impulse usually is to jump to the ground, where its black legs, blending with the background of earth, are invisible, while the top of the body being green, now appears from above like a small blade of grass. If the insect is again molested while on the ground, it jumps quickly here and there in a spasmodic manner, then catching hold of some herbage climbs upon it. After waiting sufficiently long for danger to pass, the cricket eventually springs from one small plant to another until it again finds the main stem of the horse-weed. It then climbs up to take a position similar to that which it formerly occupied. One may often find it at rest, with its legs extended nearly straight out behind the body; or it may appear on the flowers feeding. After a dry spell of weather in August, the older weeds, often selected as a residence by the crickets, present a series of dead brownish leaves below, that extend from the ground a third or more the length of the plants upwards. Because of the existence of these dead leaves and shadows, the darker parts as well as the light coloring on these insects serve as excellent protection. Moreover, as they rest on the main stem, among the maze of leaves they enjoy complete immunity from their grosser enemies. Later in the season the habits undergo some modification incident to the change in the vegetation. For instance, on September thirtieth, I visited the horse-weed patch which furnished the theme of the above narra-

tion, to find that many of the weeds, while still standing, had turned brown and were dead. There were very few crickets to be found at the point where they had been so common before. After a long search a number were located in quarters somewhat different from those in which I had previously found them. They had taken up positions near the ground. To enumerate, I discovered one female hiding ten inches above the earth, within a folded dead leaf of a ground cherry. Close by was a male on a green leaf of the same plant. Immediately following these observations, I found two more males and a female on the light, yellowish green leaves of another of these plants. Similarly, a pair which were almost invisible were crouched among the leaves and seed receptacles of a *Potentilla*. On October first, among some wild blackberry bushes, I noted a number of these crickets of both sexes walking about on the upper surface of the leaves. The slightest motion on my part caused them to seek safety by darting around the side margins of the leaves, disappearing underneath, or they would jump below. Here I found two males near together clinging on upside down, each hiding within a curled leaflet of the blackberry. A stem of one of these plants which I found here, shown in the reproduced photograph (Fig. 1, *a*), shows ten punctures made by the ovipositor of *fasciatus*. The scarring of the plant in this way did not appreciably affect the health of the branch, the leaves of which were fresh and green. The same day I located a number of rather large plants of the golden-rod, the stems of which were used by this æcanthid for depositing her eggs. The points selected for this purpose were often situated half way down the main stem. Here the darkened scar areas can be recognized on the green stems where a number may be found lying in close proximity. The holes which are near together take the form of vertical continuous lines of varying length, or they appear dotting the surface irregularly, as shown in Figure 1, *b* and *c*. A broken longitudinal section of the golden-rod at the scarred places will show the eggs disposed in the manner represented in Figure 1, *d*. Or sometimes the eggs will be found missing, and instead of them there will be encountered a white larva which destroys the eggs. This grub tunnels through the central pith, feeding on it and leaving the stems hollow.

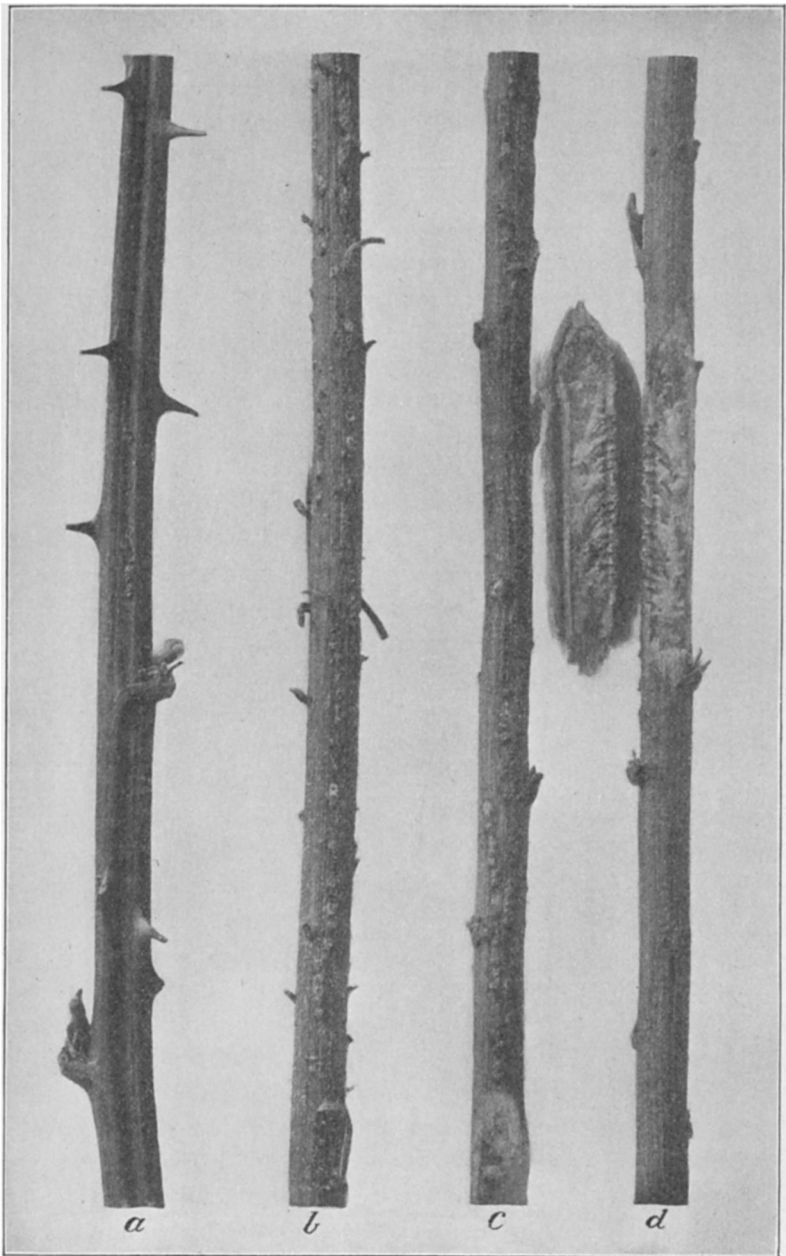


FIG. 1. — Stems of the blackberry, *a*, the horse-weed, *b*, and the golden-rod, *c* and *d*, which have been stripped of their leaves to clearly show the holes made by *Ecanthus fasciatus* during oviposition. A portion of the stem *d* has been removed longitudinally to show the eggs *in situ*. Photographed by the author.  $\times 1\frac{1}{2}$ .

*The Call Notes.*—At 11.30 on the morning of September thirtieth, as the sun became overcast by clouds, I was treated to a pretty serenade by a host of males, which being hidden in a dense thicket of weeds gave out an exquisite example of their orchestration. Beyond this spot, in the open field planted with clover, but grown over with a mixed wild herbage, which included more or less scattering of the horse-weed, I heard the shrilling. After a little experience, one is led quite easily into the presence of these crickets by their song, as the following

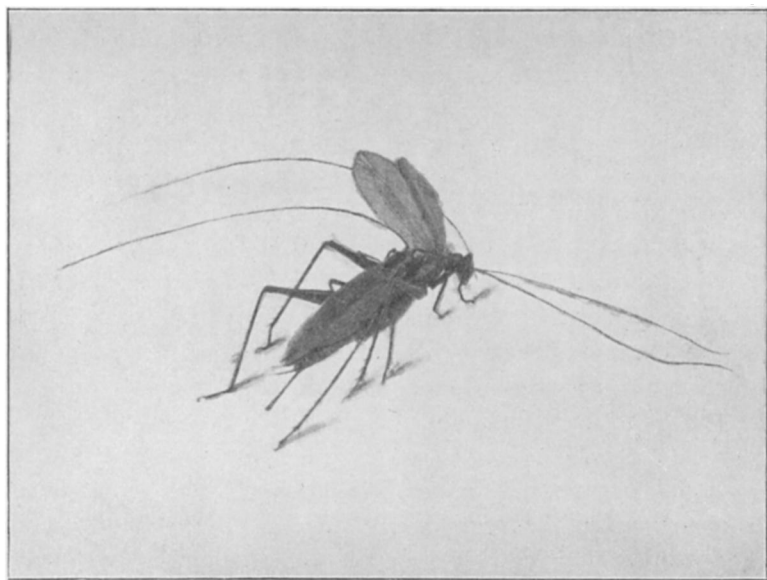


FIG. 2.—*Æcanthus fasciatus*. The female is shown on the male's back in the attitude of devouring the plasmatic secretion within the thoracic gland located at the central part of the metanotum in the male. Photographed by the author, from living posed individuals, which were first subjected to partial asphyxiation with hydrocyanic gas.  $\times 1\frac{1}{2}$ .

incident will prove. At 2.30 in the afternoon of October first, during the bright warm sunlight, I heard what seemed to be a chorus of *fasciatus* emanating from a source quite a distance off. From the open field where I stood, I gradually traced the trills to a corner of an adjoining unmowed field where the crickets appeared in abundance in a small wild blackberry patch. On near approach some of the songs ceased, but they soon commenced again when I stood perfectly quiet.

After nightfall, as well as in daytime, the high-pitched shrill notes of this œcanthid are uttered at irregular intervals, sounding not unlike the croaking of a frog or of a sparrow's notes when heard at a distance. They are not so monotonous as those of the large familiar black gryllid, or so resonant as the notes of the mole cricket. The concerts accompanying their little social gatherings may well be placed among the choicest of insect orchestrations.

*Method of Alluring the Female during Courtship.*—The male of this œcanthid possesses a remarkable mechanism for alluring the female during the period of courtship. He not only uses the pretty modified tegmina as an artifice in attracting her, but he also brings into operation a most peculiar thoracic device about to be described. In order to attract the female, the male, having approached within her sight, commences his advances by elevating his transparent tegmina to a nearly vertical position or right angle. Then separating them so that their surfaces rub together in and out, he produces a high-pitched shrilling for the female's benefit. She, in turn, being readily attracted by these notes moves towards him, and climbing on his back goes sufficiently far forward that her attention is further drawn to the little odd-shaped glandular fossa on the back of the thorax between the wings. Here she at once inserts her mouth to find a delicious potion secreted for her special needs, and which she devours ravenously, as depicted in Figure 2. The male in the meantime may or may not cease his singing, but while she is availing herself of the curious plasmatic drink, his tegmina are continually elevated, and his wings, which are folded at his sides, undergo a slight rhythmical motion in and out, lasting during the five to ten minutes she is usually content to stay. When she moves away he backs around towards her, again elevating his tegmina and repeating his song. Similarly affected by his overtures, and remembering the reward of sweets awaiting her return, she again mounts his body and proceeds to partake from his loving cup. These executions are repeated several times as a preliminary to the sexual act. Now the female is prepared by some subtle influence exerted by the male and she stays near by ready to again answer to his allurements. He

finally raises his tegmina in full display, and singing again to her she immediately reciprocates by mounting his body, but instead of indulging in his loving cup this time, she curves the end of her abdomen slightly downward, while at the same time he backs up and raising the end of the abdomen, conjugation is effected. The latter process lasts but a few seconds. After the sexual act, the female may be seen curving the end of her abdomen underneath forward, in order that she may clean the ovipositor with her mouth and include the genitalia in this toilet.

I have frequently observed the males in active combat over the possession of the female. As a result of these struggles, later on in the season, the males become decidedly dilapidated in appearance, the legs and wings having suffered more or less destruction as the result of the many contests for supremacy.

*The Alluring Gland.* — The function of the gland (Fig. 3), as above intimated, is solely for the purpose of alluring the female and it may be classed as a secondary sexual organ. It may be described as a moderately deep fossa, situated in the center of the metanotum of the thorax. It is bounded laterally by convex, rather obtusely rounded sides which converge and coalesce in front. Here anteriorly the border is flattened or depressed. On either side before the middle the lateral borders are strongly tumose, being provided with numerous sensitive hairs, the lateral borders behind the middle being continued into narrow convex ridges. The inner margins of the lateral borders are trisinuately excavated. Behind the gland lies the anterior concave border of the scutellum. Within the gland, occupying a point opposite the middle situation on either side (Fig. 3, *c*), is a flat brush of glandular hairs which project into the cavity obliquely. Just below, on either side, is another smaller brush (Fig. 3, *b*) composed of similar hairs which are directed inwards. The posterior half of the floor of the cavity is darker in color, being chitinized, and thus showing a line of demarcation separating it from the forward translucent portion. The posterior floor is, moreover, divided by a transverse sinuous ridge, and the inner third here behind (Fig. 3, *d*) is clothed with hairs.

An experiment on live crickets demonstrated that when the hairs on the surface of the swollen anterior lateral borders (Fig.



3, *a*) were stimulated by touching them with the point of a small artist's brush, or head of an insect pin, it gave rise to a responsive movement of the wing of the opposite side of the body. The same stimulus applied to both sides at the same time caused both wings to move or jerk simultaneously.

From these simple experiments I am led to infer that the motions of the wings witnessed during the sexual performances previously described are automatic in nature. They are caused

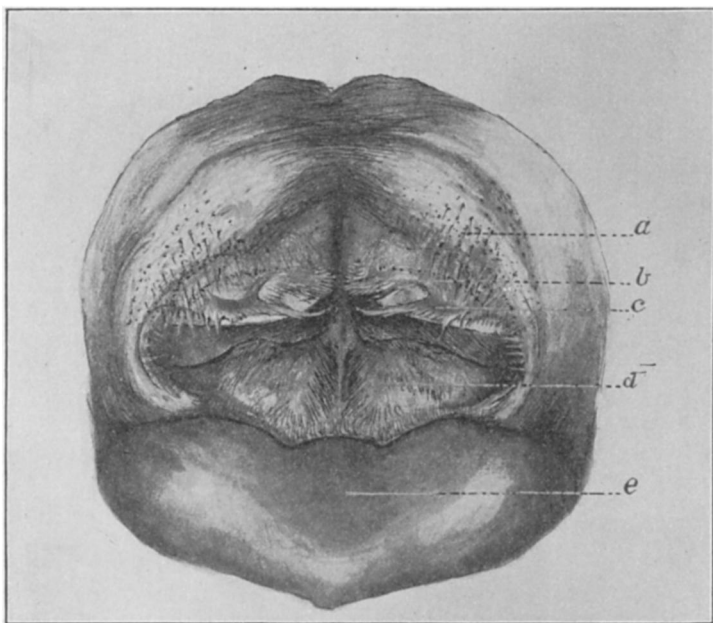


FIG. 3. — Enlarged view of the male alluring organ from above, in the scutum of *Ecanthus fasciatus*. The disposition of the sensitive hairs on the swollen lateral margins anteriorly are shown at *a*, the brush-like arrangement of the glandular hairs *b* and *c*, and the clothing of hairs on the posterior wall at *d*. Behind the organ or gland, lies the scutellum *e*. Drawn by the author.  $\times 15$ .

by the female palpi touching the sensitive hairs above alluded to, during the time she is drinking.

When examining the male, one may often find, when raising the tegmina, a small plasmatic yellow droplet of the glandular secretion on the under side of the lower tegmina, opposite the position of the gland. This is an excessive fluid secreted from the glandular hairs. The gland fossa is often found filled

with the fluid, which seems to be partially soluble in water. When the gland becomes dried out, the evaporation of moisture causes the hairs, which are normally arranged in the flat rows before mentioned, to come together forming acute pencils. These pencils then take on the appearance of teeth, quite misleading to the casual observer. A small drop of water carefully placed in the cavity, while under the microscope, soon dispels this illusion by causing the hairs to spread out in the same way that a hair brush shows its individual hairs after a dried, sticky substance has been soaked out of it. My illustration (Fig. 3) presents a view of the entire gland after being treated with a drop of water.

From the foregoing statements regarding the sexual habits and the connection of this gland therewith, it may be of interest to note that the suggestion made by Blatchley (*Orthoptera of Indiana*, p. 452), that during the mating of this species the female removes the semen from the glands whose openings are intimated to be beneath the tegmina of the male, and that she then fertilizes her ova with the secretion there obtained is, as a matter of fact, wholly erroneous. There is also a doubt regarding the correctness of certain notes of Harrington on the habits of the snowy tree cricket, which has a bearing on this subject. Howard quotes Harrington as mentioning the following: "An interesting feature of its concerts is one of which I have not been able to find any mention in books accessible. While the male is energetically shuffling together his wings raised almost vertically, the female may be seen with her head applied to the base of the wings, evidently eager to get the full benefit of every note produced." (*Insect Book*, p. 344.) My studies of the thoracic gland of the snowy cricket show this structure to be similar to that of the striped species, *fasciatus*; consequently, is it not possible that Harrington witnessed the female in the act of drinking from the gland without realizing the entire mission of her attitude? Blatchley gives an interesting account of the male wooing the female in the work before cited. He found them on the heads of the sunflower.

Besides the alluring gland above referred to, this œcanthid has a singular eversible, sacculated structure situated at the dor-

sum of the abdomen, in the fold between the third and fourth tergites. In handling the living male, and raising the tegmina with one's fingers to an angle of forty-five degrees or more, the gland may be detected. It does not protrude except during the first moments of excitement of capture when its folds are thrust out. This would indicate that the structure is a repugnatorial organ, though this is conjectural, there being no odor given off from it. A similar gland occurring in a like situation, on the dorsal aspect of the allied snowy cricket, *C. niveus*, gives to the insect, when likewise excited, a faint odor not unlike some flower.

*The Method of Oviposition.* — On October first, I examined a large number of the horse-weed and golden-rod a-field, which showed the scars where the crickets had oviposited. The fact was developed that the eggs of this species were always deposited on the sunny south exposure of the main stem of the plants. This is obviously an advantage in furnishing the necessary heat in hatching the eggs, and to the delicate young when they first emerge. In Figure 1 the serial subfigures represent the stems of the blackberry, horse-weed, and golden-rod, all shorn of leaves, to demonstrate the scars or holes, as well as the eggs *in situ*. I witnessed the act of oviposition for the first time on the afternoon of September 12, and thereafter observed it on a number of occasions. In brief the process is as follows: the female coming to a suitable spot on the stem, she prepares it by biting it with her jaws, spending scarcely a minute in doing so. Then, moving her ovipositor under her body at nearly a right angle, she places the tip into this superficial abrasion and immediately proceeds to drill a hole. The drilling is accomplished by rotating the ovipositor while keeping the end, which is provided with a dentate rasp, firmly pressed against the stem. The abdomen, which she turns from side to side, takes an active part in this procedure, acting as upon a pivot, and at times covering about forty degrees in these movements. The ovipositor is soon passed through the tough external covering and finally penetrating deeper and deeper into the pith. In the beginning the course of the hole takes a right angle, but as she proceeds its direction is changed, taking a curved inclination backwards, as

depicted in Figure 1, *d*. When the female has bored into the pith as far as the ovipositor can go, she then discharges the slightly curved egg very slowly. Then after withdrawing the organ, she finishes the process by chewing the stem at the point of entrance as she did in the beginning of the operation. The anterior, whitish tipped pole of the egg usually lies within a millimeter of the opening. This is shown in the specimen of golden-rod (Fig. 1, *d*) laid open for inspection. Some of the eggs here show the whitish micropilar extremity quite clearly. I did not see the female use the same hole for the deposition of more than one egg.

One night at 7.30, under artificial light, I observed a female boring a hole, but when she arrived at the stage where she was about to oviposit, she suddenly pulled out her ovipositor without having accomplished her purpose. It was then disclosed that the egg had stuck in its passage, for the next moment she brought the ovipositor forward underneath her abdomen and, spreading the blades apart, she extracted the egg with her mouth and rapidly ate it. This latter act does not seem to be unusual among the orthoptera under like conditions, as I have witnessed it in several widely different species. She then went over her ovipositor carefully cleaning it with her mouth. Commencing at the tip, she spent several minutes passing from the point along its entire length, giving great attention to the preparation of the base and genitalia. This latter performance seemed to have been done with a view to forestall further accidents, for almost immediately afterwards she started to again oviposit, and this time, as well as thereafter, had no difficulty in placing her eggs successfully.